

What is claimed is:

1. An electric power feeding line switching method, in which electric power is supplied from each of a plurality of electric power feeding lines to one of a plurality of repeaters with which a plurality of optical fiber transmission paths having a branching point are connected to supply the electric power to an optical communication signal transmitting through the optical fiber transmission paths, comprising the steps of:

10 superposing a control signal on the optical communication signal which transmits through the optical fiber transmission paths; and

controlling a connection relationship among the electric power feeding lines according to the control signal superposed on the optical communication signal to switch from one connection of the electric power feeding lines to another connection of the electric power feeding lines.

2. An electric power feeding line switching method according to claim 1, wherein the step of superposing a control signal includes the step of

superposing the control signal on the optical communication signal which is transmitted between terminal stations through the optical fiber transmission paths connected with the terminal stations.

3. An electric power feeding line switching method according to claim 1, further comprising the steps of:

transmitting a second control signal through one optical fiber transmission path, which is connected with one

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electric power feeding line corresponding to no fault through one repeater, in cases where a fault occurs in one of the electric power feeding lines;

earthing one end of the electric power feeding line corresponding to the fault on a side of a connection point of the electric power feeding lines according to the second control signal to disconnect the electric power feeding line corresponding to the fault from the electric power feeding lines corresponding to no fault; and

connecting the electric power feeding lines corresponding to no fault with each other at the connection point to switch from the connection of all electric power feeding lines to another connection of the electric power feeding lines corresponding to no fault.

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4. An electric power feeding line switching method according to claim 1, further comprising the steps of:

earthing one electric power feeding line on a side of a connection point of the electric power feeding lines in an initial state in which the feeding of the electric power to the other electric power feeding lines is started.

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5. An electric power feeding line switching method according to claim 1, wherein the step of controlling a connection relationship includes the step of

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switching the connection of the electric power feeding lines while monitoring an electric potential difference between an electric potential of the electric power feeding lines connected with each other at a connection point and a ground level.

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6. An electric power feeding line switching method according to claim 1, wherein the step of controlling a connection relationship comprises the steps of:

5 monitoring an electric potential difference between an electric potential of the electric power feeding lines connected with each other at a connection point and a ground level;

maintaining electric currents supplied to the electric  
10 power feeding lines; and

switching the connection of the electric power feeding lines when the monitored electric potential difference is minimized.

15 7. An electric power feeding line switching method according to claim 1, wherein the step of controlling a connection relationship includes the step of

switching the connection of the electric power feeding lines while reducing an electric current, which is supplied  
20 to a connection point of the electric power feeding lines, to a minimum current required to switch the connection of the electric power feeding lines.

8. An electric power feeding line switching method  
25 according to claim 1, wherein the step of controlling a connection relationship comprises the steps of:

controlling an electric current, which is supplied to a connection point of the electric power feeding lines, to a minimum current required to switch the connection of  
30 the electric power feeding lines;

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demultiplexing the control signal from the optical communication signal; and

automatically switching the connection of the electric power feeding lines according to the control signal demultiplexed from the optical communication signal after the electric current is controlled to the minimum current.

9. An electric power feeding line switching apparatus, in which a connection of a plurality of electric power feeding lines, each of which is connected with an optical fiber transmission path through a repeater to supply electric power from the electric power feeding lines to an optical communication signal of the optical fiber transmission paths through the repeaters, is switched, comprising:

optical signal receiving means for receiving the optical communication signal which includes a control signal and transmits through the optical fiber transmission paths;

control signal demultiplexing means for detecting the control signal by demultiplexing the control signal from the optical communication signal received by the optical signal receiving means; and

an electric power feeding line selector switch for controlling the connection of the electric power feeding lines according to the control signal detected by the control signal demultiplexing means by switching one connection of the electric power feeding lines to another connection of the electric power feeding lines.

10. An electric power feeding line switching apparatus

according to claim 9, wherein a second control signal, which transmits through one optical fiber transmission path connected with one electric power feeding line corresponding to no fault through one repeater, is received  
5 by the optical signal receiving means in cases where a fault occurs in one of the electric power feeding lines, one end of the electric power feeding line corresponding to the fault is earthed on a side of a connection point of the electric power feeding lines according to the second  
10 control signal by the electric power feeding line selector switch to disconnect the electric power feeding line corresponding to the fault from the electric power feeding lines corresponding to no fault, and the electric power feeding lines corresponding to no fault are connected with  
15 each other at the connection point according to the second control signal by the electric power feeding line selector switch to switch from the connection of all electric power feeding lines to another connection of the electric power feeding lines corresponding to no fault.

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11. An electric power feeding line switching apparatus according to claim 9, further comprising:

monitoring means for monitoring an electric potential difference between an electric potential at a terminal of  
25 the electric power feeding line selector switch at which the electric power feeding lines are connected with each other and a ground level at another terminal of the electric power feeding line selector switch; and

monitor signal outputting means for producing an  
30 optical monitor signal indicating the electric potential

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difference monitored by the monitoring means and outputting the optical monitor signal to one of the optical fiber transmission paths.

5 12. An electric power feeding line switching apparatus according to claim 9, wherein the electric power feeding line selector switch has a for-opening-feeding-line selector switching element for making one end of one electric power feeding line open on a side of a connection  
10 point of the electric power feeding lines.

13. An electric power feeding line switching system, in which a connection of a plurality of electric power feeding lines, each of which is connected with an optical fiber  
15 transmission path through a repeater to supply electric power from the electric power feeding lines to an optical communication signal of the optical fiber transmission paths through the repeaters, is switched, comprising:

a plurality of terminal stations, each of which is  
20 connected with one optical fiber transmission path and one electric power feeding line, for performing a communication operation by transmitting the optical communication signal through the optical fiber transmission paths, supplying the electric power to the  
25 electric power feeding lines, superposing a control signal on the optical communication signal and outputting the control signal superposed on the optical communication signal; and

an electric power feeding line switching apparatus for  
30 receiving the electric power from the terminal stations

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through the electric power feeding lines and switching from one connection of the electric power feeding lines to another connection of the electric power feeding lines according to the control signal transmitted from one of the terminal stations through one optical fiber transmission path.

14. An electric power feeding line switching system according to claim 13, wherein the electric power feeding line switching apparatus comprises

optical signal receiving means for receiving the optical communication signal which includes a control signal and transmits through the optical fiber transmission paths;

control signal demultiplexing means for detecting the control signal by demultiplexing the control signal from the optical communication signal received by the optical signal receiving means; and

an electric power feeding line selector switch for controlling the connection of the electric power feeding lines according to the control signal detected by the control signal demultiplexing means by switching one connection of the electric power feeding lines to another connection of the electric power feeding lines.

15. An electric power feeding line switching system according to claim 13, wherein the electric power is supplied from one or more terminal stations connected with one or more electric power feeding lines corresponding to no fault in cases where a fault occurs in one of the electric power feeding lines, a second control signal is transmitted

from one terminal station, which is connected with electric power feeding line corresponding to no fault, to the electric power feeding line switching apparatus through the optical fiber transmission path connected with the terminal station, one end of the electric power feeding line corresponding to the fault is earthed on a side of a connection point of the electric power feeding lines according to the second control signal by the electric power feeding line switching apparatus to disconnect the electric power feeding line corresponding to the fault from the electric power feeding lines corresponding to no fault, and the electric power feeding lines corresponding to no fault are connected with each other at the connection point according to the second control signal by the electric power feeding line switching apparatus to switch from the connection of all electric power feeding lines to another connection of the electric power feeding lines corresponding to no fault.

16. An electric power feeding line switching system according to claim 13, wherein one electric power feeding line is earthed on a side of a connection point of the electric power feeding lines in an initial state, in which the feeding of the electric power to the other electric power feeding lines is started, by the electric power feeding line switching apparatus.

17. An electric power feeding line switching system according to claim 13, wherein the electric power feeding line switching apparatus comprises:



monitoring means for monitoring an electric potential difference between an electric potential of a connection point of the electric power feeding lines connected with each other and a ground level; and

5        monitor signal outputting means for producing an optical monitor signal indicating the electric potential difference monitored by the monitoring means and outputting the optical monitor signal to one terminal station through one optical fiber transmission path  
10       connected with the terminal station, the connection of the electric power feeding lines is switched according to the control signal by the electric power feeding line switching apparatus while the terminal station monitoring the electric potential difference according to the optical  
15       monitor signal.

18. An electric power feeding line switching system according to claim 17, wherein the terminal station supplies a feeding current to the electric power feeding  
20       lines to maintain the feeding current supplied to the electric power feeding line switching apparatus while monitoring the electric potential difference according to the optical monitor signal, the terminal station controls the feeding current to minimize the electric potential  
25       difference, and the electric power feeding line switching apparatus switches the connection of the electric power feeding lines in cases where the electric potential difference is minimized.

30       19. An electric power feeding line switching system

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according to claim 13, wherein the electric power feeding line switching apparatus comprises:

selector switch controlling means for controlling the connection switching of the electric power feeding lines to switch the connection of the electric power feeding lines according to the control signal after an electric current supplied to a connection point of the electric power feeding lines is reduced by one terminal station to a minimum current required to switch the connection of the electric power feeding lines.

20. An electric power feeding line switching system according to claim 13, wherein the electric power feeding line switching apparatus has a for-opening-feeding-line selector switching element for making one end of one electric power feeding line open on a side of a connection point of the electric power feeding lines.